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Fire Prevention in Heritage Buildings

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Edited by Martin E. Weaver

Cover Photo
Victoria Fire Department
Horse-drawn steam fire engine, 1901 - 1902.
Provincial Archives of B.C. photo

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Bradshaw, J., *Heritage Conservation in British Columbia: A Selected Bibliography*, 1979.

Collier, R., *Guidelines for Restoring Brick Masonry*, 1981.

Patterson, R.M., *Manual for the Preparation of "As Found" Drawings*, 1982.

Collier, R., *Guidelines for Storefronts of Heritage Buildings*, 1982.

Harper, D., *Trees and Towns*, 1983.

Cassidy, M., *Local History in British Columbia*, 1983.

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Foreword

Since its inception in 1977, the British Columbia Heritage Trust has been developing new ways to "support, encourage and facilitate the conservation, maintenance and restoration of heritage property in the Province." One such way is the Technical Paper Series.

Although a great deal of general information on heritage subjects is already available, there has been a growing request for concise treatment of specialized subjects within the British Columbia context. Themes are therefore drawn from the fields of history, archaeology, architecture and preservation technology. The British Columbia Heritage Trust invites suggestions for further studies in this series.

Martin Segger
Series Editor

Introduction

Provincial Archives of B.C. photo

Government House, Victoria, before the fire.

Every year an alarming number of heritage buildings, large and small, are lost to this and future generations through fire.

A fire usually develops in four stages:

1. **Incipient** — This first stage can develop over several hours or even days. There is no visible smoke, flame or heat. Combustion particles rise to the ceiling like a gas. Extinguishing a fire at this stage causes minimal damage.
2. **Smouldering** — Smoke particles are visible but there is no flame and little heat.
3. **Flame** — Ignition occurs. Flame is visible and heat increases.
4. **Heat** — Large amounts of heat, flame, smoke and toxic gases are produced.

This manual outlines some of the measures that can be taken to prevent fire in heritage buildings.

Provincial Archives of B.C. photo

Government House, Victoria, after the April 15, 1957 fire.

1. What is a Heritage Building?

A heritage building is one which may have either architectural or historical significance or both. In this paper we are concerned with heritage buildings which range in size from the Vancouver Court House to the Atlin School House Museum. Throughout the province heritage buildings are being used as museums, galleries, restaurants, shops and private residences. Only a small percentage have been designated.

In Canada all buildings are subject to the requirements of the relevant provincial Building Codes and Fire Codes. These codes are mainly directed towards new construction and heritage buildings often do not comply with them. It can sometimes be difficult to make the buildings comply without aesthetically or physically damaging historic features.

This paper will examine some of the alternative approaches which are beginning to be accepted for the provision of appropriate life safety standards in heritage buildings.

Everyone will agree that life safety is the primary concern when a fire prevention plan is designed. For heritage buildings, the second important concern is to design a system that will not destroy or overpower any architecturally or historically significant features. Modern fire detection and suppression technology has solved many of these problems.

Kate Williams photo

Smith House, Vernon.

2. Building and Fire Codes

Under the British North America Act, legal jurisdiction over public fire protection was designated a provincial responsibility. The provinces turned firefighting over to the municipalities and retained fire prevention, inspection and investigation.

Building and fire prevention standards continue to be set by national codes, as follows:

The National Building Code (NBC) establishes the standard of fire safety for the construction of new buildings, the reconstruction of buildings including extensions or alterations, buildings involving a change of occupancy and upgrading of buildings to remove an unacceptable fire hazard.

The National Fire Code (NFC) establishes the standard for fire prevention, firefighting and life safety in buildings in use, including standards for the conduct of activities causing fire hazards, maintenance of fire safety equipment and egress facilities, standards for portable extinguishers, limitations on building contents and the establishment of fire safety plans including the organization of supervisory staff for emergency purposes. In addition, the NFC establishes the standard for prevention, containment and fighting of fires originating outside buildings which may present a hazard to a community and sets standards for the transportation of flammable and combustible liquids. These codes are usually adopted and enforced by provincial legislation.

Rossland Historical Museum photo

Interior, Fire Hall, Rossland, 1901.

Kamloops Museum and Archives photo

Kamloops Fire Department, 1919.

3. Compliance Alternatives for Heritage Buildings

Although both national and provincial codes are not specifically designed for heritage buildings, they have to be applied to them. What has been needed is a set of guidelines for building inspectors to outline compliance alternatives for older buildings. At present, if a code official permits a departure from the code, he or she may be held legally responsible for any death, injury or damage resulting from the non-compliance. The compliance alternative guidelines would then free the inspectors from fear of prosecution if they allowed anything other than literal compliance. These guidelines, which would work as a supplement to the codes, would treat heritage buildings objectively in terms of life safety but deal with them sympathetically for architectural preservation.

For instance, many proposed building and fire code compliance alternatives are contingent on the use of sprinkler systems which may cause many museum curators and all conservators to have apoplexy. However, sensitive collections can be protected by a wide combination of detection and suppression systems. Alternative systems are discussed in Chapter 5.

Ontario has lead the way in Canada in the development of alternative means of compliance for heritage buildings. Following are some examples of compliance alternatives.[3]

Ontario Building Code Statement	Compliance Alternatives Suggested
9.6.5.2. Glass side lights greater than 18 in. in width that could be mistaken for doors, glass in storm doors and glass in sliding doors within or at every entrance to a dwelling unit shall be safety glass of the laminated or tempered type conforming to CGSB 12-GP-lc(1973) "Glass, Safety, Tempered or Laminated for Building Construction," as revised to 1 May 1975 or shall be of wired glass.	Existing doors and sidelights exceeding the specific glass area need not conform to the provisions of this section affecting safety glass.
9.3.3.1. Lumber for the use listed in Table 9.3.3.A. shall be identified by the grade stamp of an association or independent grading agency approved to grade stamp lumber by an appropriate organization acceptable to the chief official.	Sound salvaged or original materials shall be acceptable for reuse or continuing use subject to limitations of other sections of OBC.
9.8.1.	Where existing stairs, because of poor condition, are required to be repaired or replaced, they may be rebuilt as per the existing stairs.
9.8.3 to **9.8.5** OBC requirements for stairs are (in part) as follows: a) min. 34" wide b) min. 32" max. 36" railing height c) min. 6'-4" clearance over tread nosing d) landings to be at least same width as the stair e) no doors to swing over a stair f) min. 9" tread 9" from edge in curved stairs g) max. 1 set winders through 90° in 30° sections h) max. 8" rise, min. 8¼" run and min. tread width of 9¼"	Extension of existing stairs (systems) in Single Family Dwellings only, either to the basement or to the upper floor, shall be exempt from the provisions of this section, provided they at least match the existing stairs, but shall be: a) 28" wide b) min. 32" max. 36" railing height c) min. 6' clearance over tread nosing d) min. 30" length intermediate landings e) with no doors swinging on stairs f) min. 8" tread 9" from edge in curved stairwells in exits g) max. 1 set winders through 90° in 30° sections h) max 9" rise, min. 8" run

4. Developing a Fire Prevention Plan for Heritage Buildings

Guidelines for Preservation of Heritage Buildings

The following are basic guidelines to consider before designing a fire prevention program for a heritage building:

- A compatible use for the heritage building should be found which will not require major alterations to the structure.
- The distinguishing original characteristics should be kept (shape and number of windows, doors, roofline, etc.).
- Some changes are evidence of the history and development of the building and should remain because they are significant in their own right.
- Distinctive examples of skilled craftsmanship (e.g. plasterwork) should be treated with sensitivity.
- Deteriorated features should be repaired rather than replaced and should match the original in composition, design, colour and texture. Repair or replacement of architectural features should be based on accurate duplication of features based on historical, physical and pictorial evidence.

Contemporary design for additions should match the size, scale, colour, material, and character of the property, neighbourhood and environment so that if the alterations were removed, the essential form and integrity of the structure would be intact.[1]

A key ingredient for protecting heritage buildings against fires is a fire prevention plan. The fire prevention plan begins with a site inspection report which should identify fire hazards, existing protection and make any necessary recommendations for upgrading protection.

First, prepare measured drawings of the site plan, exterior elevations and interior floor plans.

Then check the following:

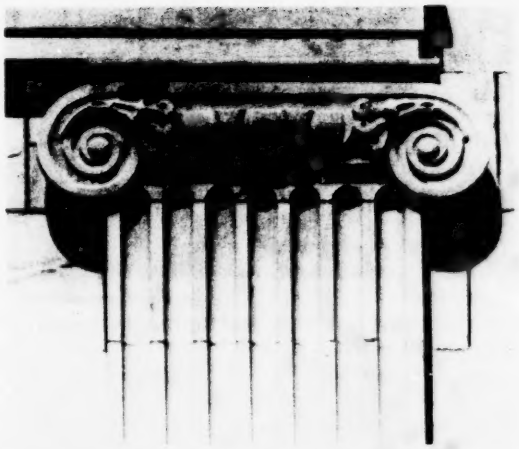
- ☐ property identification
- ☐ original building plans
- ☐ if building codes were in effect when the building was constructed, what were their requirements?
- ☐ changes that have taken place
- ☐ existing life safety features
- ☐ common hazards, e.g. flammable textiles, drapes
- ☐ special hazards, e.g. solvents
- ☐ the location, source and quantity of water supply
- ☐ the location of existing extinguishing systems and devices
- ☐ the location of existing alarm and detection systems
- ☐ exterior load-bearing walls - How do they support floors and ceilings? (e.g. balloon, or platform construction?)
- ☐ exterior non-load-bearing walls
  - Do they contain a fire within the building?
  - Do they keep an exterior fire out where openings are located?
  - What materials are used for windows, door frames, doors and shutters?
  - Is wired glass used in windows and doors?
  - What is the thickness of framing?
  - What is the distance to adjacent buildings?
- ☐ interior load-bearing walls - Which interior walls are load bearing?
- ☐ interior non-load-bearing walls - What are the differences in functions, construction, and materials of these walls? Measure the thickness of all walls to within 5 mm.
- ☐ the structural frame - Where are any columns, beams located? Measure their size and spacing. Try to rely on accidental openings to do this, rather than coring every wall.

- ☐ floors and ceilings - What is the distance between supports? Make an opening to verify. Check suspended ceilings.
- ☐ the roof - Is it watertight? What is the thickness? How many layers? What types of materials are used?
- ☐ the doors - Do they have self-closing devices? Do they fit tightly in the frame? Are the hinges in good condition? What is the thickness of panels?
- ☐ wall penetrations - How many holes have been made over the years in walls, ceilings and floors for plumbing pipes, heating ducts and electrical wires? It is important to locate these openings where heat and gas can travel vertically and horizontally. Fill openings with non-combustible material or upgrade and protect in another way.

Fire prevention planning is greatly influenced by the intended use of the building. For interim protection (consolidation of the building during the planning stage) if the building is closed, life safety requirements are minimal and the primary concern is to protect the building against arson. New development (infill designed for contemporary functional standards) and period reproduction (accurate reproduction of poorly preserved historic structures) present fewer problems than a restoration where the equipment must not intrude on the historic fabric of the building.

The fire prevention plan should also include emergency procedures to be used in case of fire, e.g. sounding the alarm, notifying the fire department, evacuating occupants, confining, controlling and extinguishing the fire. Staff should be appointed and trained to carry out fire safety duties which include holding fire drills, control of hazards, building maintenance and providing alternative measures for life safety.

For major structures, the final decision for the fire prevention plan should be made by a fire protection engineer, hopefully one who is sympathetic to the historical and architectural requirements for the building and who is familiar with the compliance alternatives allowed for heritage buildings.



Philip Graham photos

5. Fire Detection and Suppression Systems

A local alarm such as a hand bell, gong or triangle is effective in a limited area and only if there is someone there to sound it and if it is heard. On the other hand, an automatic fire alarm tied into an ionization detector registers the fire location with the local fire department.

In order to simplify the detector selection process:

- analyse the combustible materials
- identify the source and types of fires that may start
- estimate the time required for the products of combustion to be detected.

Response times vary depending on the location of the detectors and the source of fire. Photoelectric detectors are sensitive to smouldering fires but slow for smokeless flaming fires. Ionization detectors respond quickly to aerosol products of a flaming fire and react later to smouldering fires. The height and shape of the ceiling are important considerations when determining choice and location of detectors.

Fire Detectors

Detection systems can be classified by their placement, functional characteristics and operating principles.

Thermal Detectors

- fixed temperature - an alarm will sound when the atmosphere reaches a predetermined temperature. It should be installed on low ceilings..
- rate of rise detectors - alarm will sound when there is a sudden increase in the room temperature at the rate of 9°C per minute. This detector will given an alarm earlier than fixed temperature sensors. These come in two different forms:
  a) spot detectors — a few centimeters in diameter which can be mounted in the ceiling
  b) line detectors — a loop of metal tubing or wiring which can unobtrusively circle a plaster medallion.

Smoke Detectors

Smoke detectors respond to aerosols released in a fire. They can be used in elevator shafts and ventilation shafts to activate dampers to reduce the spread of smoke.

Fire Extinguishers

To start, a fire needs combustible materials, oxygen and a temperature high enough to ignite the material. Conversely, a fire can be extinguished by wetting, cooling, smothering or breaking the chemical chain reaction.

Three classifications of fire are prevalent in the destruction and damage to heritage buildings.

Class A — organic materials such as paper, textiles, wood. This type of fire can be extinguished by blanketing and wetting.

Class B — oils, grease, paint, flammable liquids. Smothering or blanketing removes the oxygen.

Class C — electrical. A non-conducting extinguishing agent is required for this type of fire.

Types of Extinguishers

Foam Extinguishers

These are effective against Class A and B fires but not Class C, electrical fires. They need not be replaced if they are in satisfactory condition and suitable for the location in which they are installed but they are no longer standard equipment. Replace an expired foam extinguisher with a multipurpose dry chemical one. Foam extinguishers must be recharged annually and are subject to freezing. The active

ingredients are sodium bicarbonate and aluminum sulphate.

Carbon Dioxide (CO_2)

Carbon dioxide systems work by reducing the oxygen content in flammable liquids. Carbon dioxide is heavier than air, does not conduct electricity but has poor cooling properties over a long period of time. Equipment can be fixed or portable, manual or automatic. One pound of carbon dioxide is required for every 18 cu. ft. of air space. Evacuation is necessary because the fog reduces both visibility and the oxygen required for breathing. However, carbon dioxide is on the way out; it can damage glass, "burn" skin because of ultra low temperature and is a hazard in confined spaces.

Halons

Halon is a hydrocarbon in which one or more hydrogen atoms are replaced by halogen atoms. Halon 1301, the least toxic of the halons, has no residual poisonous effects up to 7% volume. The excellence of this interior automatic fire suppression system is widely acknowledged. It is very unobtrusive but the biggest drawback is the cost. A test alone in a heritage building could cost several thousand dollars. Halons are ideal for small specialized storage areas where the cost would not be prohibitive.

Standpipe and Hose

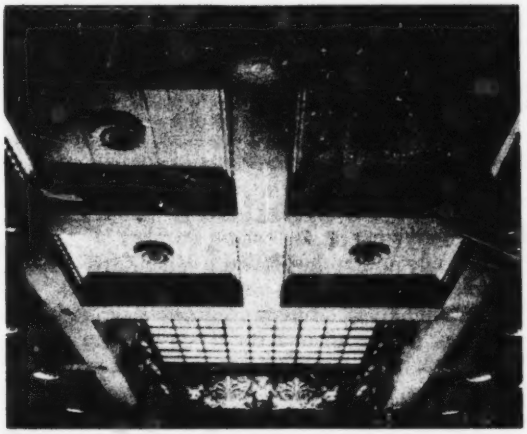
A standpipe and hose system can complement water sprinklers but it is very obtrusive. A glass, china or art collection would be blown away by a 50mm hose with a 38mm nozzle even in experienced hands. Store the hose with its nozzle adjusted to a fine spray and inspect the system every two months.

Automatic Smoke Dischargers

These systems consist of a set of traps which open and close automatically when activated by an ionization detector. This system draws off combustible gases and smoke to exterior air, prevents the temperature from rising and reduces smoke damage to the interior and furnishings. Increased visibility facilitates human evacuation.

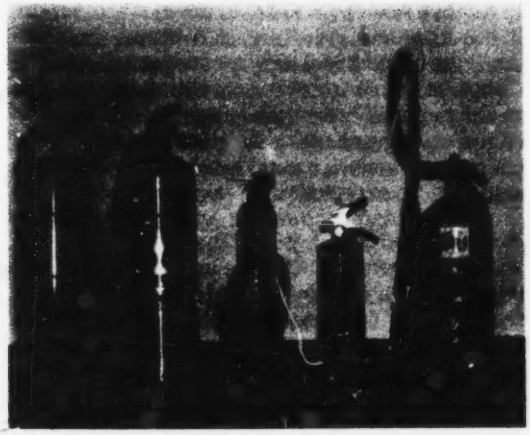
Sprinklers

Sprinklers are part of a permanently piped system which is connected to water under pressure. At a predetermined temperature water is released from the sprinkler head usually through the breaking of a fusible link. Two types of sprinklers are wet pipe and dry pipe. **A wet pipe system** requires an unlimited supply of water and can not be used where freezing may occur. In a **dry pipe system** heat-activated sprinklers are attached to a pipe containing air under pressure. At a preset temperature, the air pressure is reduced, the dry pipe valve is opened and water flows. A dry pipe system can be used on roofs or other areas subject to freezing temperatures. In a heated area, an alarm sounds, allowing time to turn off the system if the fire is under control. Any leakage in sprinkers can be monitored and only heated sprinklers are activated.



American Association for State and Local History photo

Fire detectors in place.



Fire Commission of Canada photos

Hand-held fire extinguishers.

6. A Guide to Fire Protection in Heritage Buildings

Arson

Every year an increasing number of historically and architecturally significant buildings fall victim to arson. In 1980, British Columbia had 1,208 suspected or known cases of arson.

Of all the reasons for arson, (e.g. pyromania, revenge, extortion) the profit motive dominates. Owners have their buildings burned to collect insurance for business losses, to avoid tax arrears and liens, to cover code violations, to make room for new construction, to remove tenants in order to convert buildings to condominiums, and significantly for this study, to avoid historic district regulations. Cooperation among fire, police, building and health departments, banks, insurance companies, municipal government and community groups can do much to bring these arson statistics down.

Arson Watch System

In cooperation with the local fire department, a neighbourhood watch committee can organize block meetings to train residents to identify and eliminate fire hazards, to prepare escape plans and to install and use detection and suppression equipment.

Vacant buildings undergoing renovation present a high risk for arson. The neighbourhood watch should report suspicious behavior to police and request the building and health inspectors to have the building properly sealed.

Projects that neighbourhood watch committees have successfully completed include:

- clean up - local merchants provide supplies and food; the city: trucks and some personnel
- fire extinguisher and smoke detector campaign - obtain bulk rates on detection and suppression equipment
- fire hydrant and call box inspection - supplement the regular inspections by the municipality
- site inspection of buildings
- "adopt a heritage building."

With a little research, the committee should be able to determine if a particular building is a high risk for arson. The fire department has records on the date, location and cause — accidental, suspicious, arson — of fires in the neighbourhood. In addition, there may be a description of the buildings, the owners' names, the insurance company and perhaps the value of the policy. This information should be recorded on a fire map index.

From the tenants, one can obtain information on rents (are they in line with similar buildings), vacancy rates, management attitudes, the condition of the building and security. (Have there been small warning fires to encourage tenants to leave?) From the register of deeds, the committee can determine how often the building has been sold, the sale price (frequent change of owners may be a guise to inflate the price and corresponding insurance), the mortgage, any liens or judgements against the owner, the name of the insurance company and the amount. Go to the city clerk to find out if taxes on the building are in arrears and if the property is designated as a heritage building. Designation will affect the changes the owner can make to the building. Some owners feel a vacant lot is more valuable than a heritage building. The building and health departments will have records of any code violations. Publicity is the key in preventing arson.

If, after gathering as much information as possible on the building, it seems to be a high risk for arson, inform the owner the building is being watched. The city can work with the owner to upgrade the building. Strict

enforcement of codes may lead to arson. The city can reduce the profit motive by putting a lien on burnt buildings to recover taxes. Insurance companies can reduce claims for overinsured buildings. There is a need for clear definition of penalties for arson. Of the 1,208 cases of arson in British Columbia in 1980 only 157 persons were charged. By maintaining an Arson Watch System the community can help turn these figures around.

Chimneys

Before using any fireplace or wood burning appliance, do a thorough inspection of the chimney.

Check the following:

- ☐ Do pipes or wires run through the chimney?
- ☐ Is the throat plugged?
- ☐ Was the fireplace designed for wood or gas?
- ☐ Does woodwork tie-in to the chimney? It may be necessary to do alterations to cut timbers free.
- ☐ Is there a separate flue for each fireplace and furnace? The flue should be lined with metal for gas furnaces. Because gas burns at a lower temperature than wood or oil, moisture can condense in the chimney. This moisture can lead to the breakdown of the masonry with the result that carbon monoxide leaks into the building. The condensation will also cause staining on exterior and interior walls.
- ☐ What is the condition of the mortar? Deteriorated mortar can allow flames and gases to penetrate the building.
- ☐ Is the chimney high enough? It should be at least 1 meter above the roof to prevent sparks from landing on the roof.
- Is the chimney capped? A cracked cap or one which does not extend on all sides at least 50mm will allow moisture into the masonry. Each flue should extend 50mm above the cap.
- What is the condition of any parging? Parging may cover missing or loose bricks and loose mortar. Freeze-thaw cycles cause parging to break down quickly allowing moisture into the masonry.

The risk of chimney fires can be reduced by following these recommendations:

- cleaning the chimney twice a year
- scraping the chimney opening above the grate to remove any deposit of cresote
- burning dry wood. Green wood with sap produces more creosote.
- avoiding newspapers. A paper fire sends flames beyond the damper; the burning paper is caught in the updraft and may descend onto the roof.
- testing the integrity of the flue. Place temporary blockings over the top and bottom of the flue and insert a smoke candle. The dense chemically generated smoke will reveal cracks and holes in flues.

If you have a chimney fire, here are some things to do while waiting for the fire department:

- Throw rocksalt or sodium bicarbonate (baking soda) on the hearth. Do not use water which will produce steam and cause damage to the chimney.
- Keep doors and windows closed to limit the amount of air which can enter the flue.
- Remove readily combustible material, e.g. rugs, furniture, from the front of the fireplace. Also remove light objects which may be sucked into flue by strong updraft.
- Block the opening into the flue with a wet sack. Close the fireplace opening with sheet-metal. These measures restrict the flow of air into the flue and prevent burning soot from falling into the room.
- Feel the chimney in other rooms and attic and remove any combustible material in contact with the hot chimney.

Surface Coatings

Intumescent Paints

Intumescent paints swell when heated or touched by flame to form a blanket of insulation which protects the treated surface from fire. Intumescent paints are not fireproof or fire resistant but they delay the rate of flame spread on a combustible surface.

The advantages of intumescent paint are that it allows extra time to escape and it can be applied over a lower cost product of otherwise unacceptable combustibility. There are, however, certain disadvantages. Intumescent paint is difficult to apply and it is necessary to build up the paint to a minimum thickness for it to be effective. It is expensive at $60.00 per gallon and has a limited life during which it must be maintained. Because of its noxious fumes, the area must be well ventilated during application. Finally, the paint is highly flammable when applied and must cure in a safe environment.

Intumescent paint might be used as a compliance alternative on the edges of doors to form a seal.

Electrical System

The electrical system in a heritage building requires a thorough inspection by a professional electrician. However, the following few items can be easily checked by a building custodian.

Exterior

Do the incoming wires come in contact with trees, porches, balconies, loose trim, etc.? If so, take corrective measures to protect the insulation.

Rating

Is the present system adequate? The capacity or amperage of the electrical system

can be determined by the size of the cable. This information is printed on the sheathing. If the printing is worn, an electrician can determine the capacity of the system.

Service Size	Conductor Size
15 amps	#14 copper wire
20 amps	#12 copper wire
30 amps	#10 copper wire
40 amps	# 8 copper wire
60 amps	# 6 copper wire
100 amps	# 3 copper wire

A 60 amp system is adequate for stove, hot water heater and dryer. A small three-bedroom home requires a 100 amp system, whereas a large single family or small multifamily dwelling required a 200 amp system.

Knob and Tube

In turn-of-the-century buildings "knob and tube" wire can still be found. A knob is a white ceramic insulator which supports the wire when it changes direction. The tube, another form of white ceramic insulator, protects timber joists where the wire runs through them. For knob and tube systems, two wires run separately, insulated with rubber sheathed in braided cotton. The rubber perishes with time and the cotton becomes brittle and may fray, thus exposing the wire to accidental contact and risk of shorting and fires.

Grounding

An electrical system should be grounded to the plumbing system. When an appliance short circuits, there is an overload on the wires which can lead to overheating, melting insulation, sparks and possibly fire. Grounding provides an emergency path for the increased load; it must be attached to the street side of the water meter to provide a continuous electrical path to the ground. In rural areas a rod must be driven at least 3 metres into the ground and the grounding wire attached to it.

Extension cords

Extension cords are usually a lighter gauge than permanent wiring and may overheat. Watch out for overloading of circuits by use of too many appliances on an extension.

Receptacles

Keep receptacles clean and free from dust. Worn, corroded, pitted or overloaded electrical contacts can cause arcing which may lead to fire. Check for overheating at receptacles which may indicate arcing. Sparks can ignite combustible dust.

Check electrical leakage from receptacles with a neon bulb circuit tester. A circuit between the black wire and the box which results in a bright glow indicates the box is properly grounded. A weak glow between the ground wire and the box shows leakage.

Tightly packed thermal insulation around or in receptacle boxes can cause excessive heat build-up which causes insulation on wires to deteriorate and may lead to fire. Foamed-in-place plastic thermal insulation may also prevent requisite heat loss from cables not in conduit, causing cables to overheat possibly to the point of causing a fire.

Fixtures

Bulbs should be no larger than the fixture is designed for, and should not be in contact with or too close to combustible material, e.g. lamp shades or wood (see wattage ratings on fixtures).

Check to see that recessed lighting is adequately ventilated.

In fluorescent lights, defective tubes can cause an excess current which overheats the wires and may lead to a fire.

Motors

Short circuits produce arcing, overheating and burnout. Keep motor clean of dust, lint, oil or grease build-ups. Check to see that motors are protected by overloading devices.

Following is a summary checklist for your electrical sytem:

- ☐ system overfused?
- ☐ insulation missing?
- ☐ nothing hanging from wires, e.g. kites?
- ☐ wiring supported at regular intervals?
- ☐ closed junction boxes used to join cables?
- ☐ cable not run on surface of joists, walls, ceilings? (thus exposed to accidental damage)
- ☐ wire from porch light enclosed in waterproof conduit?
- ☐ loose connections?
- ☐ no wiring adjacent to heat sources which could melt or damage insulation, e.g. wiring run against steam heating pipe?

Fuels

Ideally, fuel storage tanks should be buried underground in the open. Vapours given off by volatile fuels are heavier than air; therefore, a storage tank room should be well ventilated at the bottom. Avoid gravity feed from fuel tanks. A fire valve to cut off the supply of oil in the event of fire should be fitted to the outlet pipe from the tank.

Do not bring open flame into this area.

Dispose of leaky containers. Keep containers tightly closed. Do not refuel lamps, lawnmowers or heaters while they are hot. The appropriate extinguisher for a Class B fire is dry chemical (i.e. for oils, grease, paint and flammable liquids.)

Furnaces

The furnace room must be separated from the rest of the building by one-hour rated fire walls and self-closing fire doors. Install a "rise of heat" detector and a sprinkler over the furnace. Check the condition of the flue, chimney and combustion chamber. Chimneys with gas furnaces must have a metal liner in the flue. Automatic fire dampers in the ductwork should be tied into smoke detectors. Check the electrical wiring and ensure that the fuel is not gravity fed but has a shut-off valve.

Lightning Protection

Over 200 fires were started by lightning in British Columbia in 1980. In flat open country where there is a serious fire or explosion risk, e.g. in timber barns, lightning rods are a good investment. A bolt of lightning can be as powerful as 100,000 amps. Lightning rods provide a low resistance path to the ground. The rods must be arranged so that no point of the structure or historically significant trees are outside the protection zone. The zone resembles a cone with its apex at the highest point of the rod. The radius of the base of the cone equals the height. The copper lightning rod is connected at its lower end to an earth electrode. Check that connections are still sound. The spire of an early nineteenth century church in Ontario was found to have four lightning conductors, only one of which was properly connected to ground.

The resistance of the conductor which runs from the rod to the earth electrode should not exceed 10 ohms. Salting soil with rock salt is a cheap and effective method of lowering the resistance of the buried earth electrode. However, this may corrode the electrode; therefore, ground should be checked electrically at yearly intervals.

Conductors should run on outside walls. Avoid bends near uninsulated metal pipes. Also avoid sharp bends around flammable features such as wooden cornices; a strike may arc across the bend and ignite the wood. There is a danger of flash over to uninsulated metalwork in a building with steel frame construction, concrete reinforcement bars, metal roofs and utility service pipes. Side-flash can be minimized by installing insulation on conductors. All parts of the lightning conductor system should be separated from thatched roofs by a space of at least 1 metre by non-metallic supports.

Outbuildings with no electricity or metal water pipes need more protection than a house. Test and inspect the system twice a year. A sure way to invite disaster is to lay a new roof over the conductors.

Rubbish Dumps

Burning rubbish near heritage buildings is a dangerous practice. The location of the dump should be chosen so that a fire may safely burn. Do not dump flammable liquids on easily ignitable materials. Depending on the hazard, fires in dumps can be left to burn out naturally, sealed with earth or extinguished by spreading calcium carbonate (chalk or limestone) over the fire. Heat releases carbon dioxide from the chalk. The remaining quicklime expands and fills gaps in the rubbish. Old shingles and other discarded woodwork from heritage buildings on which linseed oil and turpentine finishes had accumulated have been known to burn explosively.

Shafts

In some older apartment buildings, bathroom and bedroom windows opened into a shaft for ventilation. These shafts must normally be constructed to resist a fire for ¾ hour. Install metal framed wireglass windows and smoke detectors in the shafts. "Hold-open" devices on the windows which are electrically tied into the smoke detectors will close the windows automatically in case of fire. Check that no temporary props or ties prevent closure.

Thermal Insulation

Inspect any cellulose insulation to determine if it has been pre-treated with borax or other fire retardant/fungicidal mixtures? If this insulation becomes wet, acids will form which will corrode electrical conduits and junction boxes (See also references under electrical system receptacles).

Toxic Hazards of Fires

More deaths are caused by smoke and gas than by flames during a fire. Smoke, composed of very fine solid particles and condensed vapour, acts as an irritant to eyes greatly reducing visibility and adversely affecting body functions. Gases produced from burning

organic and inorganic materials, in sufficient quantities over a short period of time, will cause death.

Despite the numerous studies underway in North America, no standard has been established for the toxic effects of gases produced in fires. Following is a table which indicates some of the lethal gases which may be present in a fire. The increased use of synthetic polymers in buildings greatly increases the level of toxic gases.

Safety Precautions

Open Flame in Historical Interpretation

A combination of open flame, period costume and exuberant children presents a serious fire hazard. Indirect lighting is a preferred alternative to candles and lamps. Always keep a fire blanket near an open flame. For smokey fireplaces in period buildings, infra-red flame detectors mounted over either side of the fireplace will sound an alarm when flame crosses their beams. Some museum staff have been known to disconnect their smoke detectors when fireplaces were in use and often staff members forget to turn them back on at the end of the day. In this situation infra-red detectors are preferable.

Blow Torches

Blow torches are effective paint removing tools but **should only be used on the exterior** of a heritage building and even then only if there is no alternative. The following safety precautions must be observed:

- Do not use in or immediately adjacent to roof spaces, e.g. under eaves.
- Remove all waste including birds' nests and wood shavings or saw dust (n.b. these latter materials were historically used for thermal insulation).
- Keep two fire extinguishers close at hand.
- Insulating shields can protect combustible materials.
- Make thorough checks at the end of the day for smouldering fires. Flames have been known to creep under clapboard, setting fire to sawdust insulation, or through joist channels where they burn undetected for hours.
- Do not leave the area unattended.
- Know the location of phones, alarms and use of extinguishing equipment. The "hot work permit" which follows is a means to keep control of the procedure.

Hot Work Permit*

Date .....

Permission is granted to .....

to use ..... in the ..... (exact location)

between ..... a.m. and ..... a.m.
..... p.m. ..... p.m.

☐ The above location has been examined.

☐ There are no combustible liquids, vapours, gases or dusts.

☐ All combustible matreial has either been removed or suitably protected against heat and sparks.

☐ A person will be standing by with an extinguisher/hose reel while the operation is in progress.

☐ She/he and the operatives have had the nearest fire alarm/telephone pointed out to them and have been told what to do in the event of a fire.

Signature of person issuing permit and position held .....

☐ For at least one hour after the period of work a continuous check was made of the area and adjacent areas for signs of smouldering fires.

Signature of person responsible for the work .....
(After signing return permit to the person who issued it.)

*Applicable to all operations involving flame, hot air or arc welding and cutting equipment, brazing and soldering equipment, blowlamps, bitumen boilers and other equipment producing heat or having naked flames.

Main Harmful Combustion Products of Materials and General Harmful Effect[5]

Material	Harmful Product	Harmful Effect
Wood and paper	Carbon monoxide (CO)	Dangerous concentration 4000 ppm in air (30 min)
Polystyrene	CO - also styrene, but present in smaller quantities	
Polyvinyl Chloride (PVC)	HC1 - also corrosive	Dangerous for even short exposure 1000 - 2000 ppm
Plexiglas or perspex	CO - also methylmethacrylate which is as toxic as CO but produced in smaller quantities	
Polyethylene	CO	
Acrylic Fibres Wool Nylon	 Hydrogen cyanide (HCN) CO	 120 - 150 ppm

Wood Preservatives

Wood preservatives when applied *in-situ* can present a fire hazard. Two types of wood preservatives which may present a fire hazard are those with tar oils, or organic solvents.

Coal tar creosote preservative used for railway sleepers, fence posts and garden woodwork has a flash point of 71°-76° C (160°-170° F). When applying wood preservatives, keep away from open flame.

Some flammable organic solvents commonly used in wood preservatives are white spirit, kerosene, naphtha and gas oil. Avoid open flame and disconnect electricity. Ensure that electrical supply cannot be switched back on again or reconnected by persons not aware of hazard, i.e. post notices and padlock or seal switch-gear. Do not smoke. Ensure good ventilation. Do not spray junction boxes and hot surfaces such as light bulbs. The surface of the treated wood can support flame for 48 hours and there may be an increased rate of fire development for up to 170 hours after application. The atmosphere may also contain explosive or flammable solvent vapour/air mixtures.

Water-borne preservatives, such as those which contain copper, chrome and arsenate, are no fire hazard and offer a small degree of flame retardance.

Appendix A

Check Lists·

Preliminary Check List

Premises should be thoroughly checked in order to establish and maintain reasonable fire safety standards. The check lists below provide a useful start for a wide variety of different types of buildings. They should be added to and altered to suit the particular premises concerned. Checks, as appropriate, should be made:

- ☐ at the beginning of each day
- ☐ at close-down or at night
- ☐ periodically (major checks required at less frequent but regular intervals)

1. **Construction:**
   ☐ fire resistive ☐ noncombustible ☐ combustible

2. **Size:**
   floor area _____
   number of floors _____
   number of connecting buildings or wings _____
   number of entrances _____
   number of emergency exits _____
   number of employees _____
   number of visitors per day,
   average _____
   maximum _____

3. **Exposures:**

	Serious	Moderate	Light-None
☐ north	☐	☐	☐
☐ east	☐	☐	☐
☐ south	☐	☐	☐
☐ west	☐	☐	☐

4. **Water Supply:**
   ☐ municipal system ☐ reservoir/pond ☐ storage tanks
   capacity _____
   size of water mains _____
   distance from hydrants _____

5. **Fire Service:**
   ☐ municipal ☐ volunteer ☐ local brigade
   time required for fire service to reach building _____

6. **Fire Protection:**

	Yes	No	Partial
standpipe system	☐	☐	☐
sprinkler system	☐	☐	☐
automatic fire detection system	☐	☐	☐
inert gas extinguishing system	☐	☐	☐
interior fire alarm system	☐	☐	☐
direct alarm to fire service	☐	☐	☐
monitored night guard service	☐	☐	☐
fire walls and self-closing fire doors protecting horizontal openings between building units	☐	☐	☐
furnace room separated from rest of building by fire walls and self-closing fire doors	☐	☐	☐
fire walls and self-closing fire exhibit and collections storage area	☐	☐	☐
fire resistive enclosures protecting stairways and other vertical openings	☐	☐	☐
exit doors opening outward	☐	☐	☐
locked exit doors equipped with panic hardware	☐	☐	☐

7. **Furnace:**
   ☐ one-hour rating for enclosure walls
   ☐ sprinkler over furnace
   ☐ condition of flue, chimney, combustion chamber
   ☐ automatic fire alarm

List of any changes in character of building, occupancy, water supply or hydrants, accessibility or other general conditions affecting fire safety since the previous inspection: .....
.....

General Inspection

1. **Roof**

	Yes	No
Is roof covering noncombustible?	☐	☐
Are drains unobstructed?	☐	☐
Are lightning arrestors in good condition?	☐	☐
Are skylights protected by screens?	☐	☐
Is access to fire escapes unobstructed?	☐	☐
Do fire escape stairs appear to be in good condition?	☐	☐
Are fire escape stairs unobstructed?	☐	☐
Are standpipe and sprinkler roof tank and supports in good condition?	☐	☐
Are standpipe and sprinkler control valves secured in proper position?	☐	☐

2. **All Floors** (inspect from top floor to basement):

Are self-closing fire doors unobstructed and properly equipped with working closing device?	☐	☐
Are fire exits and directional signs properly illuminated?	☐	☐
Is emergency lighting system operable?	☐	☐
Are corridors and stairways unobstructed?	☐	☐
Are fire exits unlocked and unobstructed?	☐	☐
Are sprinklers unobstructed?	☐	☐
Are standpipe hose outlets properly marked and unobstructed?	☐	☐
Are sprinkler control valves properly labelled and unobstructed?	☐	☐
Are recorded weekly inspections made of all sprinkler control valves to make certain they are open?	☐	☐
Are dry pipe valves (for sprinklers in areas exposed to freezing) in service, with air pressure normal?	☐	☐

- Are all fire-detection and fire-suppression systems in service and tested regularly? ☐ ☐
- Are sufficient fire extinguishers present? ☐ ☐
- Are extinguishers of the proper type? ☐ ☐
- Are extinguishers properly hung and labelled? ☐ ☐
- Are extinguishers properly charged and tagged with inspection tags? ☐ ☐
- Is housekeeping properly maintained? ☐ ☐
- Are cleaning supplies safely stored? ☐ ☐
- Are all trash receptacles emptied daily? ☐ ☐
- Are supply closets and slop sink areas clean and orderly? ☐ ☐
- Are electric hot plates, coffee makers and space heaters prohibited or limited to those with an appropriate automatic shut-off bearing the label of a recognized testing laboratory? ☐ ☐

3. **Ground Floor:**
   - Do entance and exit doors provide unobstructed egress? ☐ ☐
   - Is safe egress uncompromised by security measures? ☐ ☐
4. **Basement:**
   - Is rubbish removed from the building daily? ☐ ☐
   - Is rubbish removed from the premises on regular schedule? ☐ ☐
   - Are stocks of flammable liquids stored away from the building? ☐ ☐
   - Are sprinklers unobstructed and 457mm above stored material? ☐ ☐

Special Area Inspection

1. **Exhibit Areas:**
   - Are exhibit housings, fittings and other accessories non-combustible or fire retardant treated? ☐ ☐
   - Does exhibit wiring conform to the National Electric Code? ☐ ☐
   - Do all electrical components bear a label of recognized testing laboratory? ☐ ☐
   - Have exhibit installations kept exit routes unobstructed and visible? ☐ ☐
   - Have exhibit installations kept fire hose outlet valves and fire alarms unobstructed and visible? ☐ ☐
   - Is proper salvage equipment ready for use? ☐ ☐
2. **Collections Storage Areas:**
   - Is appropriate fire extinguishing equipment at hand and unobstructed? ☐ ☐
   - Are dust covers fire retardant treated? ☐ ☐
   - Is proper salvage equipment ready for use? ☐ ☐
   - Does fire service have access to areas? ☐ ☐
   - Are catalogue and accession records in a safe place? ☐ ☐
3. **Laboratories:**
   - Are flammable solvents and other chemicals properly labelled and stored in small quantities in ventilated safety storage cabinets? ☐ ☐
   - Are flammable liquids dispensed from safety cans? ☐ ☐
   - Are self-closing safety waste disposal receptacles available at work stations? ☐ ☐
   - Are laboratory wastes disposed of daily with appropriate special precautions? ☐ ☐
   - Are spray-coating facilities adequately and safely ventilated? ☐ ☐
   - Is electrical equipment in the spray area explosion-proof? ☐ ☐
   - Does the spray area have automatic fire extinguishing equipment? ☐ ☐
   - Does laboratory electrical equipment bear the label of a recognized testing laboratory? ☐ ☐
   - Do electrical appliances have warning lights? ☐ ☐
   - Are appliances unplugged when not in use? ☐ ☐
   - Are exit routes unobstructed? ☐ ☐
   - Are employees aware of special hazards and trained in necessary precautions? ☐ ☐
   - Is fire suppressant and personnel safety equipment appropriate for the special hazards that are present? ☐ ☐
   - Is entry limited to authorized persons? ☐ ☐
4. **Shops and Packing/Unpacking Areas:**
   - Are paints, thinners and other flammable liquids properly stored in reasonable quantities in ventilated safety cabinets? ☐ ☐
   - Are thinners and solvents dispensed from safety cans? ☐ ☐
   - Are self-closing waste receptacles used for oily rags and other wastes liable to spontaneous heating? ☐ ☐
   - Are flammable packing materials stored in self-closing safety containers? ☐ ☐
   - Are power tools and machines properly grounded? ☐ ☐
   - Do woodworking machines have proper dust collectors? ☐ ☐
   - Are dust collector bins emptied regularly? ☐ ☐
   - Do paint-spraying facilities comply with local codes? ☐ ☐
   - Does welding equipment meet local codes? ☐ ☐
   - Are power tools unplugged when not in use? ☐ ☐
   - Are exit routes unobstructed? ☐ ☐
   - Are sufficient fire extinguishers of appropriate type present for extra hazards associated with this kind of occupancy? ☐ ☐
5. **Auditorium and Classroom:**
   - Is safe capacity posted? ☐ ☐
   - Is occupancy restricted to the capacity posted as safe? ☐ ☐
   - Do furnishings and wall coverings comply with fire safety standards? ☐ ☐
   - Are exits unobstructed, unlocked and properly illuminated? ☐ ☐
   - Are aisles unobstructed? ☐ ☐
   - Does projection room meet local codes?
6. **Restaurant or Tearoom:**
   - Is capacity posted? ☐ ☐
   - Is occupancy limited to safe seating capacity? ☐ ☐
   - Are exit routes unobstructed and properly illuminated? ☐ ☐
   - Are ranges, hoods and exhaust ducts cleaned? ☐ ☐
   - Do exhaust ducts terminate in a safe place? ☐ ☐
   - Are grease ducts and deep fryers equipped with automatic fire detectors and extinguishing systems? ☐ ☐
   - Note date when ranges, hoods and exhaust ducts were last cleaned _____

Exterior Inspection

1. **Evacuation:**
   - Have all exits, emergency exits and fire escapes unobstructed passage to safe areas? ☐ ☐
2. **Environment:**
   - Are grounds clear of accumulation of flammable material? ☐ ☐

Have neighbouring occupancies minimized exterior fire hazards? ☐ ☐
Is fire service access clear? ☐ ☐
Are standpipe and sprinkler systems connections unobstructed and operable? ☐ ☐
Are hydrants unobstructed? ☐ ☐

Personal Inspection:

1. **Training:**
   - Do all staff members know how to transmit a fire alarm? ☐ ☐
   - Do all staff members know their assigned duty in evacuating the building? ☐ ☐
   - Do all staff members know how and when to use portable fire extinguishers? ☐ ☐
   - Do all staff members know their responsibilities in fire prevention? ☐ ☐
2. **Organization:**
   - Is the fire protection manager or designated alternate on duty? ☐ ☐
   - Does he/she have an adequate training program in operation for self and staff? ☐ ☐
   - Is the written fire emergency plan up to date and properly distributed? ☐ ☐
   - Has the fire service planned or trained for protecting the building since the previous inspection? ☐ ☐

Note date of latest fire drill. _____

Workers

- 'Permit to Work' system adopted ☐ ☐
- Smoking prohibited in danger areas ☐ ☐
- Blowlamps, cutting, welding, bitumen boilers, other heating processes and rubbish burning only allowed by agreement (See Hot Work Permit) ☐ ☐
- Combustibles removed or protected before work starts ☐ ☐
- Checking procedure instituted for detecting smouldering fires after work ceases ☐ ☐
- Checking procedure instituted for safety of temporary electrical lighting and power circuits after work ceases ☐ ☐
- Fire extinguishing and alarm facilities available ☐ ☐
- Fire procedure explained to workers ☐ ☐

Arson

- Premises adequately supervised ☐ ☐
- Waste, flammable liquids and stores — keep away from and out of easy reach of visitors and passers-by ☐ ☐
- New casual staff working under supervision ☐ ☐
- Doors, windows, fences, gates in good repair ☐ ☐
- Buildings and gates secured against intruders at the end of the day ☐ ☐

Last thing at night/at close down

In historic buildings most large fires occur at night, after people have gone home or gone to bed. The following checks should be made:

- Are open fires safe (with spark guards in position)? ☐ ☐
- Do storage or other convector heaters have anything draped over them to impede circulation of air or cause overheating or fire? ☐ ☐
- Are TV sets and other electrical appliances not required to be 'on', switched 'off' and plugs removed from sockets? ☐ ☐
- Have any cigarettes been left smouldering? ☐ ☐
- Are all doors closed? ☐ ☐
- Is the building secured against intruders? ☐ ☐

Special Comments

Inspection made by: ..... Date: .....

Title: ....

Report reviewd by: ..... Date: .....

Title: ....

Corrective Action:

Item	Referred to
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....

Corrective actions competed: ..... Date: .....
Fire Protection Manager

Appendix B

Organizations

Associate Committee on the National Building Code (ACNBC)
(National Research Council of Canada)
Ottawa, Ontario K1A 0R6

American National Standards Institute (ANSI)
1430 Broadway
New York, N.Y. 10018 U.S.A.

American Society for Testing and Materials (ASTM)
1916 Raco Street
Philadelphia, PA. 19103 U.S.A.

Canadian Government Specifications Board (CGSB)
c/o Department of Supply and Services
88 Metcalfe Street
Ottawa, Ontario K1A 0S5

Canada Mortgage and Housing Corporation (CMHC)
Ottawa, Ontario K1A 0P7

Function: Minimum property standards for existing residential buildings

Standards for the rehabilitation of residential buildings

CMHC — standards - identify work which may be funded under Residential Rehabilitation Assistance Program (RRAP) Canadian Electrical Code

Canadian Standards Association (CSA)
178 Rexdale Boulevard
Rexdale, Ontario M9W 1R3

Dominion Fire Commission (DFC)
Public Works Canada
140 O'Connor Street
Ottawa, Ontario K1A 0M3

Heritage Canada Foundation (HCF)
P.O. Box 1358, Station B
Ottawa, Ontario K1P 5R4

National Fire Protection Association (NFPA)
470 Atlantic Avenue
Boston, Mass. 02210 U.S.A.

National Research Council (NRC)
Division of Building Research
Ottawa, Ontario K1A 0R6

Rolf Jensen and Associations
797 Don Mills Road
Don Mills, Ontario M3C 1V1

Functions: Fire protection engineers
National Building Code
National Fire Code

Underwriters' Laboratories of Canada (ULC)
7 Crouse Road
Scarborough, Ontario M1R 3A9

Stabilization — is a process of intervention which may be used as an interim measure on a severely deteriorated building or it may involve the long-term consolidation of a structure. (e.g. Fort Rodd Hill, Victoria, B.C.)

Outdoor Architectural Museum — involves entire buildings displayed in an open air environment. The museum may include endangered buildings which have been moved to the site, reconstructions of non-extant buildings or recreations of buildings characteristic of a population area. (e.g. Barkerbille, B.C.)

Glossary A

Heritage Preservation

The following explanations compiled by the Heritage Canada Foundation describe some of the processes that are applied to heritage buildings.[2]

Preservation — a generic term for the broad range of processes associated with the restoration, rehabilitation and adaptive re-use of historic structures. Other activities, including the identification, evaluation, interpretation, maintenance and administration of historic resources, form an integral part of the movement to retain elements from the past.

Revitalization — describes the process of economic, social and cultural redevelopment of an area or street. Often the buildings in these areas (e.g. Nelson, B.C.) are of heritage merit despite their state of neglect prior to revitalization.

Renovation — a generic term used to describe various levels of intervention including remodelling, recycling and rehabilitation. It refers to the improvement of existing buildings or neighbourhoods.

Restoration — the process of returning a building or site to a particular period in time. The degree of intervention and the removal or replacement of parts, may be determined by an historical event associated with the building or by aesthetic integrity. (e.g. Craigflower Manor, Victoria.)

Rehabilitation — often used interchangeably with renovation to describe the modification of an existing building. This process extends the structure's useful life through alterations and repairs while preserving its important architectural, historical and cultural attributes. (e.g. the British Columbia Parliament Buildings.)

Adaptive Re-use — implies the recycling of an older structure often for a new function. Extensive restoration or rehabilitation of both the interior and exterior is usually involved. (e.g. the Old Courthouse, Vancouver.)

Retrofitting — involves the upgrading of an existing building to meet code requirements (e.g. fire or emergency exits). This process often includes the installation of new insulation as a means of energy conservation. Examples: The Installation of storm windows, smoke detectors, new insulation, new heating and electrical systems.

Remodelling — a process which involves the upgrading or replacing of interior components frequently in rooms such as a kitchen or bathroom.

Glossary B

Fire Protection

Aerosol — invisible products of combustion.

Amp — a unit defining the rate of flow of electricity.

Breeching — a **flue pipe** or chamber for receiving flue gases from one or more **flue** connections and for discharging these gases through a single **flue** connection.

Circuit breaker — automatic switch used in panel box that disconnects the flow of electrical current whenever the circuit is overloaded. It can be reset.

Class A fire — a fire involving combustible materials such as wood, cloth and paper.

Class B fire — a fire involving a **flammable** or **combustible liquid**, fat or grease.

Class C fire — a fire involving energized electrical equipment.

Class D fire — a fire involving a combustible metal.

Closed container — a container so sealed by means of a lid or other device that neither liquid nor vapour will escape from it at ordinary temperatures.

Closure — a device for shutting off an opening through a construction assembly, such as a door or a shutter, and includes all components such as hardware, closing devices, frames and anchors.

Combustible construction — that type of construction that does not meet the requirements for noncombustible construction.

Combustible dusts — dusts and particles ignitable and liable to explode, including resulting from the handling or processing of grain, malt and the manufacturing of flour and feed.

Combustible fibres — finely divided combustible vegetable or animal fibres and thin sheets or flakes of such materials which in a loose, unbaled condition present a flash fire hazard, including cotton, wool, hemp, sisal, jute, kapok, paper and cloth.

Combustible liquid — any liquid having a **flash point** at or above 38° C (100° F) and below 60° C (200° F).
Energy release — radiant energy and coverted thermal energy.

Exit — that part of a **means of egress** that leads from the **floor area** it serves, including any doorway leading directly from a **floor area**, to a public thoroughfare or to an **approved** open space.

Fire compartment — an enclosed space in a **building** that is separated from other parts of the **building** by enclosing construction providing a **fire separation** having a required **fire-resistance rating.**

Fire damper — a **closure** which consists of a normally held open damper installed in an air distribution system or in a wall or floor assembly, and designed to close automatically in the event of a fire in order to maintain the integrity of the **fire separation.**

Fire-protection rating — the time in hours or fraction thereof that **a closure,** window assembly or glass block assembly will withstand the passage of flame when exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed in a fire or building code.

Fire resistance — the property of a material or assembly to withstand fire or give protection from it; as applied to elements of buildings, it is characterized by the ability to confine a fire or to continue to perform a given structural function, or both.

Fire-resistance rating — the time in hours or fraction thereof that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived therefrom as prescribed in a code.

Fire separation — a construction assembly that acts as a barrier against the spread of fire and may not be required to have a **fire-resistance rating** or a **fire-protection rating.**

Fire stop — a draft-tight barrier within or between construction assemblies that acts to retard the passage of smoke and flame.

Firewall — a type of **fire separation of noncombustible construction** which subdivides a **building** or separates adjoining **buildings** to resist the spread of fire and which has a **fire-resistant rating** as prescribed in a code and has structural stability to remain intact under fire conditions for the required fire-rated time.

Flame-spread rating — an index or classification indicating the extent of spread-of-flame on the surface of a material or an assembly of materials as determined in a standard fire test as prescribed in the National Building Code of Canada 1977.

Flash point — the minimum temperature at which a liquid within a container gives off vapour in sufficient concentration to form an ignitable mixture with air near the surface of the liquid.

Flue — an enclosed passageway for conveying **flue** gases.

Flue pipe — the pipe connecting the **flue** collar of an appliance to a **chimney.**

Fuse — interrupts the electrical current when circuit is overloaded - must be replaced with correct amp rating.

High occupant load — an **occupant load** where the number of persons in a room or **floor area** is such that the area of floor per person is not more than 3.6 sq. m. (12 sq. ft.)

Ionization detector — measures the concentration of particles by measuring variations in an electrical current caused by the particles when they ionize.

Means of egress — a continuous path of travel provided by a doorway, hallway, corridor, exterior passageway, balcony, lobby, stair, ramp or other egress facility or combination thereof, for the escape of persons from any point in a **building, floor area,** room or contained open space to a public thoroughfare or other **approved** open space. **(Means of egress** includes **exits** and **access to exits.)**

Noncombustible construction — a type of construction in which a degree of fire safety is attained by the use of noncombustible materials for structural members and other **building** assemblies.

Photoelectric detector — uses an incandescent bulb or light emitting diodes. Aerosols change the intensity and direction of the light which activates the alarm.

Occupant load — the number of persons for which a **building** or part thereof is designed.

Ohm — unit for measuring electrical resistance in a conductor.

Volts - ohms = amperes.

Signatures — products of fire which can be detected.

Volt — measure of electrical pressure.

Watt — measure of electrical power A X V = Watts.

Bibliography

"Automatic Fire Detection: False Alarms". *Fire Protection Association Journal*, 1970, 146 (No. 88): 146-148.

Barnes, Alan. "Contingency Planning." *O.M.A. Quarterly*. Vol. 9, No. 2 (Spring 80): pp. 9-11.

Becker, Norman. *The Completed Book of Home Inspection*. New York: McGraw Hill, 1980.

Berend, TenCate. *Rehabilitation Skills Training Inspection and Specifications Workshop: Fire Safety Module*. Vancouver: Canada Mortgage and Housing Corporation, 1980.

Bhatnagar, Vijay Mohan. *Fire Retardant Formulation Handbook*. Westport, Connecticut: Technomic, 1972.

Buggey, Susan. "Researching Canadian Buildings: Some Historical Sources." *Social History*. Vol. X, No. 20 (November 1977).

Canada Mortgage and Housing Corporation. *Heating with Wood Safely*. Ottawa: Canada Mortgage and House, 1981.

Canada Mortgage and Housing Corporation. *Residential Rehabilitation Assistance Program Standards for the Rehabilitation of Residential Buildings*. Ottawa: Canada Mortgage and Housing Corporation, 1979.

Canada Automatic Sprinkler Association. *Sprinkler Requirements in the National Building Code of Canada*. Toronto: Canadian Automatic Sprinkler Association, 1980.

Canadian Standards Association. *Safety Standards for Electrical Installations: Canadian Electrical Code, Part I*. Ottawa: Canadian Standards Association, 1975.

Canadian Wood Council. *Fire Protective Design Datafiles*. Ottawa: Canadian Wood Council, 1980.

Clarke, Tony. "The Need for Disaster Preparedness." *Agmanz News*. Vol. 12, No. 3 (September 1981): pp. 8-11.

Dominion Fire Commissioner. *Fire Losses 1980*. Ottawa: Minister of Supply and Services Canada, 1982.

Diller, Lynn. "Using Wood Stoves Safely." *Old House Journal*. Vol. V, No. 10 (October 1977): pp. 109, 117-119.

Engineering and Architecture Branch. *Fire Protection on Historic Sites*. Ottawa: Indian Affairs and Northern Development, 1979.

Engineering and Architecture Branch. *Task Force Report on the Application of National Building and Fire Codes and Regulations to the Rehabilitation of Heritage Buildings*. Ottawa: Indian Affairs and Northern Development, 1979.

Fidler, John. "Firefighting System for Historic Interiors." *Building Trades Journal*. Vol. 82, No. 5432 (December 1981): pp. 34.

Fire Prevention Canada Association, *Catalogue of Fire Prevention Materials*. Ottawa: Fiprecan, 1980.

Fischer, Walter R. "Fire Safety Systems: Protecting Our Treasures From Threat of Fire". *Technology and Conservation* (Fall 1976): 14-17.

Fisher Scientific Company. *Fisher Safety Manual*. Pittsburgh, Penn.: Fisher Scientific Company, 1979.

Foote, Robert A. "Lexan - What Does it Mean for Fire Fighters?" *Fire Command*, May 1973. NFPA reprint F39-4.

Griffiths, Allen D. "A Fireplace and Furnace on the Same Flue," *Old House Journal* (October 1978): pp. 113-114.

Harp, Dale W. "Intumescent Paints: A Useful Component of Fire Protection Plans." *Technology and Conservation*. Vol. 6, No. 1 (Spring 1981): pp. 30-31.

Hart, David M. *How to Date a House*. Dublin, N.H.: Yankee, Inc., 1976.

Herman, Frederick. "Avoiding Hazards from Lightning." *Old House Journal*. (April 1978): pp. 46-47.

"Historic Fire Museum Safeguarded." *Environmental Design*. Spring 1974, 4 pp.

Horton, Eva. "Chimney Sweeping." *Old House Journal*. Vol. VI, No. 8 (August 1977): pp. 49-52.

Hunter, John E. *Emergency Preparedness for Museums, Historic Sites and Archives: An Annotated Bibliography*. Lincoln, Nebraska: National Park Service, 1981.

Institute of Man and Resources. *Heating with Wood*. Charlottetown, P.E.I.: The Institute of Man and Resources, 1978.

Jenkins, Joseph F. *Protecting Our Heritage*. Boston: National Fire Protection Association, 1982.

Jensen, Rolf and Associations. *Recommendations for Regulations Governing the Rehabilitation of Existing Buildings*. Ottawa: National Research Council, 1981.

Labine, Clem. "Adding a Damper to an Older Fireplace." *Old House Journal* (March 1976): pp. 3-6.

Labine, R.A. Sr. "Beware of Plastics and Your Fireplace." *Old House Journal* (February 1978): pp. 14.

Maatman, Gerald L. "The Consultant's Role in Fire Protection." *Fire Journal* (March 1970) N.F.P.A. reprint FJ70-10.

Mahan, S.M. Jr. "More on Flue Liners." *Old House Journal* (December 1979): p. 134.

McGuire, J.H. and G. Williams-Leir. "Spread of Fire Between Buildings." *Canadian Building Digest 216* (June 1981).

Ministry of Consumer and Commercial Relations, Minister of Municipal Affairs and Housing, Ministry of the Solicitor General. *Residential Renovation Guidelines*. Toronto 1981.

Ministry of Municipal Affairs. *British Columbia Building Code*, 1979.

Parness, Alan and David H. Ashford. *Fire Safety in Historic Buildings: Technical Pamphlet 6*. London: Society for the Protection of Ancient Buildings and the Fire Protection Association, 1978.

The Preservation League of New York State, Inc. *A Primer: Preservation for the Property Owner*. Albany, New York: The Preservation League of New York State, Inc., 1978.

Public Works Canada. Technical Information Bulletins:
Electrical Fire Safety. 1976, No. 21.
Fire Emergency Organization in Government of Canada Occupied Buildings, 1979, No. 22.
Fire Retardant Treatments for Wood. 1977, No. 2.
Fire Safety in Federal Government Properties. 1979, No. 15.
Model Manual of Fire Emergency Procedures. No. 22A.
Standard for Fire Alarm Systems. 1979. DFC No. 410 (M).
Standard for Fire Extinguishers. 1976. DFC No. 401 (M).

Queen's Printer. *Fire Code, Ontario Regulation 730/81*. Toronto: Queen's Printer, 1981.

Schur, Susan. "Fire Protection at Mount Vernon: Incorporating Modern Fire Safety Systems Into a Historic Site." *Technology and Conservation* (Winter 1980).

"Smoke Detectors." *Consumer Reports*, October 1976, 41: 555-559.

Stephen, George. *Remodelling Old Houses Without Destroying Their Character*. New York: Alfred A. Knopf, 1972.

Stumes, Paul. *Behaviour of Wood in Fire*. April 1976.

Sumi, Kikuo and Yoshio Tsuchiya. "Evaluating the Toxic Hazard of Fires", *Canadian Building Digest 197* (July 1978).

Taylor, Dale L. "Fire Records: Their Importance and Use in Document Fire History", *Parks*, Vol. 6, No. 2 (July 1981): pp. 13-14.

Tiszkus, Alphonse T. and E.G. Dressler. "Fire Protection Planning for Cultural Institutions." *Technology and Conservation* (Summer 1980): pp. 18-23.

Morton, W. Brown and Gary L. Hume. *Standards for Historic Preservation Projects with Guidelines for Applying the Standards*. Washington, D.C.: United States Department of the Interior, 1979.

Nash, George. *Old Houses: A Rebuilder's Manual*. Englewood Cliffs, N.J.: Prentice-Hall Inc., 1980.

National Fire Protection Association, Boston, Massachusetts:
Protection of Library Collections. 1970. NFPA 910.
Protection of Museum Collections. 1974. NFPA 911.
Central Station Protective Signalling Systems. 1974. NFPA 71.
Local Protective Signalling Systems. 1974. NFPA 72A.
Auxiliary Protective Signalling Systems. 1974. NFPA 72B.
Automatic Fire Detectors. 1974. NFPA 72E.
Portable Fire Extinguishers: Installation, Maintenance and Use. NFPA 10.
Life Safety Code. 1973. NFPA 101.
Carbon Dioxide Extinguishing Systems. 1973. NFPA 12.
Halon 1301 Systems. 1973. NFPA 12A.
Installation of Sprinkler Systems. 1974. NFPA 13.
Dry Chemical Extinguishing Systems. 1973. NFPA 17.
Standpipe and Hose Systems. NFPA 14.
Fire Protection Guide on Hazardous Materials. 1972. SPP-1A.

Traynor, A.E. "Planning Museum Security and Fire Safety." *Museum Round-Up*. No. 80 (Fall 1980): pp. 28-33.

U.S. Department of Housing and Urban Development. *Rehabilitation Guidelines 1980*. Washington: United States Department of the Interior, 1980.
1. Guidelines for Setting and Adopting Standards for Building Rehabilitation.
2. Guideline for Approval of Building Rehabilitation.
4. Guideline for Managing Official Liability Associated with Building Rehabilitation.
6. Electrical Guideline for Residential Rehabilitation.
8. Guideline on Fire Ratings of Archaic Materials and Assemblies.

Vance, Mary. *Fireproof Building: A Bibliography*. Monticello, Illinois: Vance Bibliographies, 1981.

Windeler, Peter. "Fire: Endangers the Past for the Future." *Museums Journal* (September 1970): pp. 72-74.

Footnotes

1 Denson Groenendall, *Repair and Preservation Maintenance for Historic and Older Homes* (Harrisburg, Pennsylvania: Bureau for Historic Preservation, 1982), pp. 1-7

2 Judy Oberlander, *Historic Preservation: A Definition of Terms*. Preservation Strategy Series #3. (Ottawa: Heritage Canada Foundation, 1982).

3 *Residential Renovation - Proposed Part XI of the Building Code*. (Toronto: Ministry of Municipal Affairs and Housing, 1982).

4 Alan Parness and David H. Ashford. *Fire Safety in Historic Buildings: Technical Pamphlet 6*. (London: Society for the Protection of Ancient Buildings and the Fire Protection Association, 1978).

5 Kikuo Sumi and Yoshio Tsuchiya. "Evaluating the Toxic Hazard of Firest". *Canadian Building Digest 197*. (Ottawa: National Research Council, 1978).

6 *Protection of Museum Collections NFPA 911*. (Boston: Massachusettes: National Fire Protection Association, 1974).

7 *Fire Code, Ontario Regulation 730/81*. (Toronto: Queen's Printer, 1981).

POOR

QUALITY

ORIGINAL